CLAIMS

1. A method of obtaining information about electrical properties of a medium comprising steps of:

scanning the medium with a ground penetrating radar (GPR) system to collect at least one scan of GPR data about the medium;

determining an effective penetration limit of the GPR system into the medium based at least in part on the GPR data collected; and

obtaining the information about the electrical properties of the medium based at least in part on the effective penetration limit.

2. The method as claimed in claim 1, wherein the step of determining the effective penetration limit comprises steps of:

dividing the at least one scan of GPR data into a plurality of segments, each segment corresponding to a scan time interval;

summing a number of inflection points present in each segment to provide a plurality of summed values, one summed value corresponding to each segment;

comparing the plurality of summed values;

selecting one of the plurality of summed values that is significantly larger than any of the plurality of summed values corresponding to earlier scan intervals, to provide a selected summed value; and

selecting a time point in the segment corresponding to the selected summed value as the effective penetration limit of the GPR system.

3. The method as claimed in claim 2, wherein the step of selecting the one summed value includes selecting a first one of the plurality summed values that is significantly larger than any of the plurality of summed values corresponding to earlier scan (time) intervals, to provide the selected summed value.

4. The method as claimed in claim 2, wherein obtaining the information about the electrical properties of the medium comprises obtaining information about a conductivity of the medium and comprises steps of:

repeating the steps of scanning the medium and determining the effective penetration limit to obtain a plurality of effective penetration limits corresponding to a plurality of scans of GPR data;

recording a location in the medium of each of the plurality of effective penetration limits; and

assembling the plurality of effective penetration limits and associated locations to create a profile of conductivity values of the medium.

5. The method as claimed in claim 4, wherein the step of scanning the medium is repeated at regularly spaced intervals to obtain a plurality of substantially parallel, regularly spaced, profile lines of GPR data.

6. The method as claimed in claim 5, further comprising a step of combining the plurality of profile lines of GPR data to create a conductivity contour map that represents spatial relative conductivity variations of a scanned area of the medium.

7. The method as claimed in claim 6, further comprising a step of locating a target within the medium from the spatial relative conductivity variations of the scanned area of the medium.

8. The method as claimed in claim 6, further comprising steps of:

repeating the steps of scanning the medium at regularly spaced intervals, at a later time, to obtain a second plurality of substantially parallel, regularly spaced profile lines of GPR data.

9. The method as claimed in claim 8, further comprising a step of combining the second plurality of profile lines of GPR data to create a second conductivity contour map that represents spatial relative conductivity variations of the scanned area of the medium at the later time.

10. The method as claimed in claim 9, further comprising a step of determining temporal relative conductivity variation in the scanned area by subtracting values of the second conductivity map from corresponding values of the first conductivity map.

11. The method as claimed in claim 1, wherein the step of determining the effective penetration limit comprises steps of:

dividing the at least one scan of GPR data into a plurality of segments, each segment corresponding to a scan time interval;

summing a number of times an amplitude of the scan data within each segment changes from a positive value to a negative value and from a negative value to a positive value, to provide a plurality of summed values, each of the plurality of summed values corresponding to one of the plurality of segments;

comparing the plurality of summed values;

selecting one of the summed values that is significantly larger than any of the summed values corresponding to segments associated with earlier scan time intervals, to provide a selected summed value; and

selecting as the effective penetration limit, a point in time in the segment corresponding to the selected summed value.

12. The method as claimed in claim 1, wherein the step of determining the effective penetration limit comprises steps of:

dividing the at least one scan of GPR data into a plurality of segments, each segment corresponding to a scan time interval;

converting each of the plurality of segments into a corresponding plurality of blocks of frequency domain data;

determining a bandwidth of each of the plurality of blocks of frequency domain data;

selecting one of the plurality of blocks of frequency domain data that has a larger bandwidth than any of the plurality of blocks of frequency domain data corresponding to earlier scan time intervals, to provide a selected segment; and

selecting as the effective penetration limit a time point within the selected segment.

13. A method of determining an effective penetration limit of a ground penetrating radar (GPR) system comprising steps of:

collecting a first scan of GPR data of a region of ground being surveyed;

collecting a second scan of GPR data of the region of ground;

converting the first scan of GPR data into a first data stream comprising a first plurality of samples;

converting the second scan of GPR data into a second data stream comprising a second plurality of samples;

multiplying the first data stream and the second data stream together, sample by sample, to create a resultant scan;

dividing the resultant scan into a plurality of segments, each segment corresponding to a time interval in each of the first and second scans;

summing a plurality of samples present in each segment of the resultant scan to provide a plurality of summed values each corresponding to one of the plurality of segments;

selecting a summed value that corresponds to a significant increase relative to the summed values from segments associated with earlier time intervals, to provide a selected summed value; and

determining the effective penetration limit of the GPR system as a depth based on a chosen point in time within the segment corresponding to the selected summed value.

14. The method as claimed in claim 13,

wherein each data value of the first scan of GPR data having a positive amplitude is converted into a 1 and each data value of the first scan of GPR data having a negative amplitude is converted into a -1, such that the first data stream comprises a plurality of 1's and -1's forming the plurality of samples; and

wherein each data value of the second scan of GPR data having a positive amplitude is converted into a 1 and each data value of the second scan of GPR data

having a negative amplitude is converted into a -1, such that the second data stream comprises a plurality of 1's and -1's forming the second plurality of samples.

15. A ground penetrating radar (GPR) system for obtaining information about electrical properties of a medium, the system including a control unit configured to:

control the GPR system to scan the medium to collect at least one scan of GPR data about the medium;

determine an effective penetration limit of the GPR system into the medium based at least in part on the GPR data collected; and

infer the information about the electrical properties of the medium based at least in part on the effective penetration limit.

16. The ground penetrating radar system as claimed in claim 155, wherein the control unit is further configured to determine the effective penetration limit of the GPR system by:

dividing the at least one scan of GPR data into a plurality of segments, each segment corresponding to a time interval in the at least one scan;

summing a number of inflection points present in each segment to provide a plurality of summed values, one summed value corresponding to each segment;

comparing the plurality of summed values;

selecting one of the plurality of summed values that is significantly larger than any of the plurality of summed values corresponding to earlier time intervals, to provide a selected summed value; and

selecting a time point in the segment corresponding to the selected summed value as the effective penetration limit of the GPR system.

17. The ground penetrating radar system as claimed in claim 15, wherein the control unit is further configured to determine the effective penetration limit of the GPR system by:

dividing the at least one scan of GPR data into a plurality of segments, each segment corresponding to a time interval in the scan;

summing a number of times an amplitude of the scan data within each segment changes from a positive value to a negative value and from a negative value to a positive value, to provide a plurality of summed values, each of the plurality of summed values corresponding to one of the plurality of segments;

comparing the plurality of summed values;

selecting one of the summed values that is significantly larger than any of the summed values corresponding to segments associated with earlier time intervals, to provide a selected summed value; and

selecting as the effective penetration limit, a point in time in the segment corresponding to the selected summed value.